FIRST PLACE

Team Members:
Katherine Cantrell (Applied Educational Psychology), Lauryn Castro (Special Education), Julian Carvajal (Mechanhical Engineering), Maria Jose Londoño (Biomedical Engineering)

Project Title:
The use of AI and machine learning models to augment vocal communication for individuals with disabilities to improve social and emotional well-being

Abstract:
Effective communication plays a direct role in our emotional and social well-being. However, individuals with disabilities experience higher rates of speech delays that impede their ability to access their environment. Augmented and Alternative Communication (AAC) devices are used to help individuals communicate their needs. However, these systems can take a long time to teach not only to the user but to their caregivers and teachers as well. Depending on the device, there can be limited vocabulary and can be difficult to maintain or generalize across communication partners. Additionally, these systems replace the vocal/verbal communication of the individual rather than supplement or interpret the vocalization. Some individuals have vocal/verbal skills that are either unintelligible or only understood by caregivers but are preferred over AAC devices. Therefore, the goal of this project is to leverage artificial intelligence (AI) and machine learning models to design and pilot an accessible software that translates vocal approximations into visual and audio outputs.

Recent advances in deep learning have paved the way for more efficient and accurate automatic speech recognition (ASR) systems. Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs), particularly Long Short-Term Memory (LSTM) networks, are now regularly employed for this purpose. These networks can be trained to detect and transcribe even distorted vocal approximations. However, recognizing the varied voice modulations and patterns of people with vocal/verbal disabilities can be challenging due to the diversity of data. Transfer learning techniques, where pre-trained models are further trained on specific datasets, could make this process more effective. This would also establish models that can be adapted and fine-tuned based on individual users' vocal patterns and needs could offer more accurate and meaningful translations.

To accomplish this goal, our objectives will include (1) to develop an automated software to interpret vocal-verbal communication approximations accurately, (2) train the AI model using a diverse dataset of audio and video recordings of individuals with speech delays that will be anonymized and preprocessed to remove sensitive information, (3) pilot the automated system with 3-5 individuals with speech delay using a single case research design, (4) evaluate the effect of the software on the individual's social and emotional wellness. The results of this study would be a refined communication software and initial usability/feasibility data of the program. This project would also produce pilot data to continue evaluating the efficacy of the program through an extramural funding mechanism such as the National Science Foundation.

The proposed team of this project aligns the expertise and resources of 4 different disciplines at UTSA including speech language pathology, mechanical engineering, biomedical engineering, and behavior analysis. The diversity of this team will lead to both the technical development of the software, as well as the direct implementation and iteration of the program with individuals with communication delays. Additionally, we have partnered with the Autism Treatment Center (ATC), the largest non-profit autism provider in the San Antonio area, to help inform the initial system and pilot the software.

SECOND PLACE (tie)

Team Members:
Jared Derrick (EMBA), Charbel Gonzalez (Architecture), Jose Carrasco-Corral (Architecture), Jacqueline Garcia (Architecture)

Project Title:
Revitalizing San Antonio's Heart: Health and Wellness Park Project

Abstract:
Our project offers a local solution to the health and well-being of the homeless population by revitalizing a city park in a needed area. By creating a safe, welcoming, and inclusive space, we envision the improvement of an existing park into a space with a community center, sanitation area, stalls for vendors and markets, and a native plant garden. Through this endeavor, we aim to align with the university's commitment to community engagement and social responsibility. Our proposed Milam Park example project addresses homelessness and well-being and complements this commitment by providing a tangible solution to quality-of-life improvement for all residents, contributing to the overall vitality of the community.

From an architectural perspective, site analysis and design are key, as locations for fresh drinking water, clean sanitary facilities, and safe shelter spaces must be properly situated in a limited area. For the redesign of the park itself, we envision a place with green spaces full of local plant life as well as small sanctuary spaces for people to enjoy meditation and relaxation. This would include communal spaces for gathering and socializing and more intimate areas for meditation and relaxation.

From a business standpoint, we would include community outreach spaces for vendors to provide educational and professional opportunities such as job workshops or job placement programs. Moreover, there would be space for local pop-up health clinics to provide services such as check-ups and counseling. If space allows, a community garden could serve as an equitable food system, enhancing healthy connections between the earth, food, and community.

The resources required for this transformative project include land, personnel with diverse expertise, essential equipment for design and planning, materials for construction and refurbishment, and funding secured through partnerships with local businesses, non-profits, and medical institutions. The San Antonio Parks System Planning Process would be used as a model for site development. This process integrates three phases: Context and Assessment; Strategic Direction and Recommendations; and Plan Development and Review. Cultural and environmental considerations will be woven into the fabric of the park, along with local materials repurposing and acquisition.

This park will be more than a physical space – it will stand as a commitment to the vitality of San Antonio, embodying the city's resilience and spirit of community. As we embark on this journey, we invite the city to join us in nurturing a legacy of health, wellness, and inclusivity for all its residents.

SECOND PLACE (tie)

Team Members:
Alireza Ghavidel (Civil Engineering), Amir Ravassipour (Facilities Management), Ebrahim Mellatdoust Pordel (Electrical Engineering), Muhammad Ali (Civil Engineering), Maryam Hassanpour Ardekani (Finance)

Project Title:
Enhancing Emotional Coaching with Deep Reinforcement Learning for Optimized Utilization of UTSA Facilities

Abstract:
This pioneering transdisciplinary project aims to enhance the emotional well-being of UTSA students by integrating emotional coaching with facility utilization optimization, utilizing Deep Reinforcement Learning (DRL). DRL facilitates personalized treatments within the context of UTSA facilities, fostering a novel approach to student well-being. The project leverages expertise from civil engineering, facility management, electrical engineering, and finance.

The significance of the study lies in its potential to improve emotional resilience and academic success among students. By addressing a 67% deficit in the "Campus Master Plan," the project proposes recommendations for better resource allocation.

The project's societal impact extends beyond UTSA, offering innovative solutions applicable to workplace environments, healthcare facilities, and mental health services. By implementing DRL, the project extracts data-driven insights from student interactions with UTSA facilities, providing evidence-based emotional coaching and supporting data-driven decision-making.

The specific goals encompass enhancing emotional well-being, optimizing resource utilization, and fostering student success. Anticipated results include improved emotional resilience, more efficient facility utilization, and an overall positive impact on student success.

The proposed methodology involves using DRL, where an independent emotional coach agent makes decisions based on specific emotional states, interacting with UTSA facilities at discrete time steps. The study follows ethical guidelines in participant recruitment, ensuring privacy, rights, and welfare.

The study's procedures involve comprehensive data collection, monitoring facility utilization and emotional well-being, and post-study assessments. Results will be analyzed, and findings will inform recommendations for improving emotional well-being support and facility utilization at UTSA.

In conclusion, this project represents a groundbreaking initiative to enhance student well-being through a transdisciplinary approach, leveraging DRL to optimize emotional coaching and facility utilization at UTSA and potentially influencing broader societal well-being practices.

THIRD PLACE

Team Members:
Sara Winter (School Psychology), Maitry Lapsiwala (Architecture), Vishal Kothavade (Electrical Engineering), Josselyne Sibrian (Applied Educational Psychology), Lavine Oluoch (Cybersecurity Science)

Project Title:
Mitigating Financial Stress and its Toll on Emotional Well-being: An Analysis of Contributing Factors and Strategic Solutions

Abstract:
The UTSA Transdisciplinary Team Grand Challenge brings together a dynamic group of students with a shared mission to address issues of financial hardship and its impact on emotional well-being within economically disadvantaged communities in San Antonio, Texas. Across the United States, poverty and poor mental health have been notoriously linked to one another. One study by Ryu & Fan (2023) found that "higher financial worries were significantly associated with higher psychological distress". Specifically, San Antonio stands as the third-poorest among five major cities in Texas according to the San Antonio Department of Human Services. Furthermore, the department's 2019 poverty report revealed that "Bexar County had the 4th highest prevalence of both adults with serious mental illness and children with serious emotional conditions among all Texas counties in 2013".

Recognizing that accessibility to in-person resources is a formidable barrier in low-income communities, our team devised a comprehensive project that is convenient and attainable in nature. Our initiative entails the development of an online survey, designed to measure participants' emotional distress levels related to financial concerns. Mindful of potential internet access limitations, we have compiled a list of various library locations where individuals can access and complete the survey online (See Appendix A).

Using a Likert scale ranging from 1 (no distress) to 5 (extreme distress), participants can rate their distress level in response to items such as "Accessing affordable healthcare" and "Covering basic living expenses". To incentivize survey participation, we suggest providing incentives such as gift cards - a tangible and thoughtful token of appreciation for participants' valuable insights. The survey serves as a pivotal step in our pursuit of solutions, aiming to identify financial issues that cause the most significant emotional distress within our sample.

It is expected that participants will rate items related to paying bills, medical debt, and accessibility, significantly higher than other items. This anticipated result was based on a study by Marshall and colleagues (2021), where it was found that participants who have medical debt and difficulty paying bills were more likely to exhibit high levels of depressive symptoms and anxiety than their counterparts. Ryu & Fan (2023) also note that individuals with socio-economic disadvantages lack access to proper emotional and financial support compared to those with socio-economic advantages.

Upon discovering the most emotionally taxing financial stressors in our data, we will provide several potential solutions to combat these interconnected issues of financial and emotional well-being. Our suggested intervention and solution is to create a user-friendly mobile app with an accompanying microsite focused on spending habits and mental health resources. Our goal is to disrupt the cyclical nature of financial and emotional distress. The integration of our project is expected to yield a significant positive impact on socioeconomically disadvantaged individuals in San Antonio, Texas. Nevertheless, ongoing research is imperative to monitor the progress of our interventions and to identify any additional barriers that low-income communities may face.